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(54) Printing plate and process for production thereof

(57) A printing plate comprises a formed piece of a thermoplastic resin having open cells and a printing face carrying a printing image formed from protrusions and recesses, the protrusions having open cells, the recesses having open cells less in number and/or smaller in opening diameter than the protrusions, the formed piece having a porosity ranging from 20% to 90%, and the open cells having a cell diameter ranging from 1.0 to 200 μm. A process for producing the printing plate including formation of the recesses by light irradiation or heating is also disclosed.

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PRINTING PLATE AND PROCESS FOR PRODUCTION THEREOF

The present invention relates to a printing plate, and a process of the production thereof. Particularly, the present invention relates to a printing plate which can be prepared by thermal energy or optical energy in a simple manner, and a process for the production thereof.

Conventional printing plates include intaglio printing plates such as gravure plate, typographic printing plates such as flexographic plate and letterpress plate, lithographic printing plates such as offset plate, and mimeographic printing plates such as screen plate. However, the process for producing such a printing plate requires complicated steps of preparation of a negative or positive film from a block copy, exposure to light, washing with water, and so forth. Further, production of a rubber printing plate requires steps of engraving and molding, which is costly and takes much time in plate production disadvantageously. In recent years, direct plate production are practically conducted by use of a heat-sensitive mimeographic sheet. However, a stamp comprising a plate produced by such a process has

disadvantages of slow drying of printed ink, and less number of continuously printed copies per unit time.

The present invention intends to provide a printing plate which can be produced by a simple process at a low cost with high precision in comparison with conventional complicated processes, and is durable and capable of conducting printing of many copies.

The present invention further intends to provide a process for producing the printing plate.

The printing plate of the present invention comprising a formed piece of a thermoplastic resin having open cells comprises a printing face carrying a printing image formed from protrusions and recesses, the protrusions having openings of the open cells, the recesses having openings of the open cells less in number and/or smaller in opening diameter than the protrusions, the formed piece having a porosity ranging from 20% to 90%, and the open cells having a cell diameter ranging from 1.0 to 200 μm.

The process of the present invention for producing the printing plate comprising a formed piece of a thermoplastic resin having open cells, comprising a printing face carrying a printing image formed from protrusions and recesses, the protrusions having openings of the open cells, the recesses having

openings of the open cells less in number and/or smaller in opening diameter, the formed piece having a porosity ranging from 20% to 90%, and the open cells having a cell diameter ranging from 1.0 to 200 μm, comprises forming the recesses by irradiation of light, or by heating.

In the printing plate of the present invention, the recesses having openings of the open cells less in number and/or smaller in opening diameter includes the recesses having the cell openings entirely closed, the recesses having the cell openings partly closed, the recesses having the cell openings all smaller in opening diameters, and the recesses having both the cell openings of the original sizes and the cell openings of smaller diameter mixedly.

In an embodiment of the process for producing the printing plates of the present invention, an image corresponding to the recesses is applied directly on the face of the formed piece, and light is irradiated thereon.

In another embodiment of the process of the present invention, an image corresponding to the recesses is applied onto a light-transmissive sheet, the sheet is placed on the face of the formed piece, and light is irradiated thereon. In this embodiment,

either the image formed on the light-transmissive sheet, or the face of the thermoplastic resin reverse to the image may be brought into direct contact with the thermoplastic resin. In consideration of the efficiency of heat conduction, direct contact of the image with the thermoplastic resin is preferred.

The thermoplastic resin used for the printing plate of the present invention should have a porosity ranging from 20% to 90%, and a cell diameter of the open cell ranging from 1.0 to 200 μm. The thermoplastic resin has preferably a water retention degree ranging from 20% to 1,000%, and a density ranging from 0.10 to 0.80. The water retention degree is defined by the equation below:

Water retention degree =

[(Fully wet weight)-(Dry weight)] ÷ (Dry weight) × 100

The softening point of the thermoplastic resin should be lower than the temperature attained by application of the thermal or optical energy for the plate production, and is generally not lower than 60°C. The hardness of the resin is preferably in the range of from 10° to 90°, measured by ASKER (Trade Name) rubber hardness tester Type C (manufactured by KOBUNSHI KEIKI Co., Ltd., Japan, test method: SRIS 0101, SRIS: The Society of Rubber Industrial Japan Standard). The elongation of the resin ranges preferably from 50% to 1,000%.

The thermoplastic resin used for the printing plate of the present invention has open cells and is capable of absorbing ink, and is thermoplastic. The resin includes polyvinyl alcohol, polyurethane, polyethylene, polypropylene, polyesters, polyvinyl chloride, polyvinyl acetate, and polyvinylidene chloride, but is not limited thereto.

Various method can be employed for production of the aforementioned thermoplastic resin having an open-cell structure. In a method, a polyurethane resin, a solvent for the urethane resin such as toluene, and water are mixed; the mixture is formed into a sheet; and the sheet is heated at about 80°C for 2 minutes to evaporate the solvent for the urethane resin, and is heated to about 130°C for 2 minutes to evaporate the water. In another method, a polyurethane resin and a solvent such as DMF (dimethylformamide) are mixed; the mixture is formed into a sheet; the sheet is immersed into water to remove the solvent for the urethane resin; and is hardened. In a still another method, a material soluble to an extracting solvent like water (for example, sodium chloride for water) is incorporated into a resin by blending; the resin is formed into a sheet; and the soluble material is removed. The production method is suitably selected in consideration of the material of the printing plate, the diameter of the open cells, and so forth.

The light-transmissive sheet useful in the process of the present invention includes sheets exhibiting light-transmittance of higher than 50%, such as polyester films, polypropylene films, and tracing paper sheets, but is not limited thereto.

The thermal energy employed for the production of the printing plate can be generated by a thermal head, a laser beam, a heated dotting-wire, an infrared light beam, and the like. The infrared light beam is preferably generated by a xenon flash lamp, a flash bulb, or the like source.

In the plate production with a laser beam, the absorption sensitivity of the laser beam is improved by addition of a light-absorbing material into the thermoplastic resin.

In the plate production with a thermal head, fusion-sticking can be prevented effectively by coating the plate surface of the thermoplastic resin with a silicone resin, a fluororesin, a silicone oil, a silicone-acrylic resin, or the like, or incorporating such a material into the thermoplastic resin.

The light-absorbing image used in the process of the present invention can be formed by a black toner for PPC copying machines, a black ribbon for thermal transfer printers, a photographic negative image, a black felt-tip pen ink, or the like.

The ink for the printing plate of the present

invention is not limited specially. Any ink is useful which can be held in the open cells, including aqueous inks, oil-based inks, solvent-based inks, emulsion inks, UV-curable inks, hot-melt type inks, and the like.

With the printing plate of the present invention, or with the printing plate produced according to the process of the present invention, stamping can be conducted with high image sharpness by impregnating an ink suitable for the purpose and pressing the plate face at an appropriate pressure onto a recording medium such as a paper sheet, a film, a plastic sheet, a cloth, a glass plate, a metal plate, and a wood plate. For example, the printing plate set at a stamp holder for continuous ink supply can be used for repetitive stamping; and the one set at a cylinder of a printing machine can be used for machine printing.

In the production process for the printing plate of the present invention, thermal energy generated by a thermal head, a laser beam or a heated dotting-wire is applied directly onto the thermoplastic resin in accordance with a printing image to close partially or entirely the openings of the open cells of the thermoplastic resin by melting of the resin, whereby recess portions are formed with the unheated portions left as protrusion portions as described in the aforementioned embodiment. Thus, an image is

formed from the protrusion portions and the recess portions. In printing, ink is supplied through the protrusion portions.

In the production process with an optical energy such as infrared light, a light-absorbing image such as a black image of PPC copying is formed on the surface of the thermoplastic resin for absorption of the infrared light, and then the infrared light is irradiated thereon uniformly. Thereby the image portion is heated, and the openings of the open cells of the thermoplastic resin are closed partially or entirely by melting of the resin, and recess portions are formed relative to the unheated portions as protrusion portions as in the aforementioned embodiment. As the result, an image is formed from the protrusion portions and the recess portions.

Example 1

A polyurethane resin of 1 mm thick was used as the thermoplastic resin having open cells. A pattern of a printing image was formed on a face of the polyurethane resin with a thermal head (estimated heating temperature: 400°C) to produce a printing plate. To the reverse face of the polyurethane resin, a stamp holder was fit which was capable of supplying automatically an oil-based ink of a viscosity of 5000 cP thereto to complete the stamp.

Example 2

A polyurethane resin of 1 mm thick was used as the thermoplastic resin having open cells. A pattern of a printing image was formed on a face of the polyurethane resin with a laser beam (estimated heating temperature: 500°C) to produce a printing plate. To the reverse face of the polyurethane resin, a stamp holder was fit which was capable of supplying automatically an oil-based ink of a viscosity of 5000 cP thereto to complete the stamp.

Example 3

A polyurethane resin of 1 mm thick was used as the thermoplastic resin having open cells. A pattern of a printing image was formed on a face of the polyurethane resin with a heated dotting wire (estimated heating temperature: 200°C) to produce a printing plate. To the reverse face of the polyurethane resin, a stamp holder was fit which was capable of supplying automatically an oil-based ink of a viscosity of 5000 cP thereto to complete the stamp.

Example 4

A polyurethane resin of 1 mm thick was used as the thermoplastic resin having open cells. In the plate production, a heat-absorbing image (a negative image) was formed by a thermal transfer printer with a black ribbon, and thereon light was irradiated from a xenon flash lamp (heating temperature: 200°C) to form a

printing image pattern. To the reverse face of the polyurethane resin, a stamp holder was fit which was capable of supplying automatically an oil-based ink of a viscosity of 5000 cP thereto to complete the stamp.

Example 5

A printing image (negative image) was provided on a PPC-copying OHP sheet of a polyester of 100 μm thick. The face of this image was brought into close contact with a thermoplastic polyurethane resin of 1 mm thick having open cells. Thereon light was irradiated from a xenon flash lamp (heating temperature: 200°C) to form a printing image pattern, and thereafter the light-transmissive sheet was removed. To the reverse face of the polyurethane resin, a stamp holder was fit which was capable of supplying automatically an oil-based ink of a viscosity of 5000 cP thereto to complete the stamp.

The stamps produced in Examples 1-5 were tested for use for date-stamps, address-stamps, and receipt-stamps. Consequently, repetitive sharp stamping could be conducted without use of an ink pad.

The process for producing a printing plate of the present invention enables remarkable shortening of conventional printing plate production steps to produce stamps and printing plates for repetitive clear printing at a high production rate at a low cost. Further, by use of a light-transmissive sheet in the

production of a printing plate of the present invention, a printing image can be formed without a special machine because of thinness of the light-transmissive sheet, and images can be formed with a general-purpose machine like a commercially available word processor. Therefore, the printing plate production can be conducted by a simpler process at a lower cost.

CLAIMS:

1. A printing plate comprising a formed piece of a thermoplastic resin having open cells, comprising a printing face carrying a printing image formed from protrusions and recesses, the protrusions having openings of the open cells, the recesses having openings of the open cells less in number and/or smaller in opening diameter than the protrusions, the formed piece having a porosity ranging from 20% to 90%, and the open cells having a cell diameter ranging from 1.0 to 200 μm.

2. A process for producing the printing plate of claim 1, wherein the recesses are formed by irradiation of light, or by heating.

3. The process according to claim 2, wherein a light-absorbing image corresponding to the recesses is applied directly onto the surface of the formed piece, and light is irradiated thereon.

4. The process according to claim 2, wherein a light-absorbing image corresponding to the recesses is applied on a light-transmissive sheet, the sheet is brought into close contact with the surface of the formed piece, and light is irradiated thereon.

5. The process according to claim 2, wherein the heating is conducted with a thermal head.

6. The process according to claim 2, wherein the heating is conducted with a dotting wire.

7. The process according to claim 2, wherein the heating is conducted by irradiation of a laser light beam.

The Patent Office

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Application No: GB 9602543.2 **Examiner:** Gary Williams
Claims searched: 1-7 **Date of search:** 26 April 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B6C: CHA,CHB,CHD G2C: CHX

Int Cl (Ed.6): B41N: 1/00,1/12,1/14

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1502299	(LOGETRONICS) See Figure 5A & page 4,line 128 - page 5,line 8	1,2
X	GB 1356499	(PERKIN-ELMER) See page 4,lines 1-28 & Figure 3	1,2
A	US 4306498	(BANDO) See col.4,lines 13-68 & Figure 4	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.